Topic: Chain rule with trig functions

Question: Use chain rule to find the derivative of the function.

$$f(x) = \sin(2x)$$

Answer choices:

A $f'(x) = 2\cos(2x)$

B $f'(x) = 2\sin(2x)$

C $f'(x) = 2\sin x$

D $f'(x) = 2\cos x$

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Solution: A

Chain rule tells us to always work from the outside-in, taking the derivative of the outside function first, leaving the inside function untouched, and then to multiply the result by the derivative of the inside function.

To find the derivative of the given function

$$f(x) = \sin(2x)$$

we'll take the derivative of $\sin$, leaving the inside function untouched, and then we'll multiply that result by the derivative of the inside function $2x$. Because the derivative of $\sin x$ is $\cos x$ we get

$$f'(x) = \cos(2x)\frac{d}{dx}(2x)$$

$$f'(x) = \cos(2x)(2)$$

$$f'(x) = 2\cos(2x)$$

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Topic: Chain rule with trig functions

Question: Use chain rule to find the derivative of the function.

$$f(x) = \tan\left(4x^2\right)$$

Answer choices:

A $f'(x) = 8\sec^2\left(4x^2\right)$

B $f'(x) = 8\sec\left(4x^2\right)$

C $f'(x) = 8x\sec^2\left(4x^2\right)$

D $f'(x) = 8x\sec\left(4x^2\right)$

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Solution: C

Chain rule tells us to always work from the outside-in, taking the derivative of the outside function first, leaving the inside function untouched, and then to multiply the result by the derivative of the inside function.

To find the derivative of the given function

$$f(x) = \tan\left(4x^2\right)$$

we'll take the derivative of $\tan$, leaving the inside function untouched, and then we'll multiply that result by the derivative of the inside function $4x^2$. Because the derivative of $\tan x$ is $\sec^2 x$ we get

$$f'(x) = \sec^2\left(4x^2\right)\frac{d}{dx}(4x^2)$$

$$f'(x) = \sec^2\left(4x^2\right)(8x)$$

$$f'(x) = 8x\sec^2\left(4x^2\right)$$

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Topic: Chain rule with trig functions

Question: Use chain rule to find the derivative of the function.

$$f(x) = \sec\left(3x^2 - 2x + 1\right)$$

Answer choices:

A $f'(x) = \sec\left(3x^2 - 2x + 1\right)\tan\left(3x^2 - 2x + 1\right)$

B $f'(x) = (6x - 2)\sec\left(3x^2 - 2x + 1\right)$

C $f'(x) = (6x - 2)\tan\left(3x^2 - 2x + 1\right)$

D $f'(x) = (6x - 2)\sec\left(3x^2 - 2x + 1\right)\tan\left(3x^2 - 2x + 1\right)$

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Solution: D

Chain rule tells us to always work from the outside-in, taking the derivative of the outside function first, leaving the inside function untouched, and then to multiply the result by the derivative of the inside function.

To find the derivative of the given function

$$f(x) = \sec\left(3x^2 - 2x + 1\right)$$

we'll take the derivative of $\sec$, leaving the inside function untouched, and then we'll multiply that result by the derivative of the inside function $3x^2 - 2x + 1$. Because the derivative of $\sec x$ is $\sec x \tan x$ we get

$$f'(x) = \sec\left(3x^2 - 2x + 1\right)\tan\left(3x^2 - 2x + 1\right)\frac{d}{dx}\left(3x^2 - 2x + 1\right)$$

$$f'(x) = \sec\left(3x^2 - 2x + 1\right)\tan\left(3x^2 - 2x + 1\right)(6x - 2)$$

$$f'(x) = (6x - 2)\sec\left(3x^2 - 2x + 1\right)\tan\left(3x^2 - 2x + 1\right)$$

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